In The Claims

Please amend claims 1, 4-6, 10, 24, 26 and 27 as follows. The "marked-up" version of the amended claims are provided in the APPENDIX B attached hereafter.

REMARKS

In response to the Office Action dated November 5, 2002, claims 1, 4-6, 10, 24, 26 and 27 have been amended. Claims 1-30 are now active in this application, of which claims 1, 6, 24 and 27are independent.

Entry of the Amendments and Remarks is respectfully requested because entry of Amendment places the present application in condition for allowance, or in the alternative, better form for appeal. No new matters are believed to be added by this Amendments. Based on the above Amendments and the following Remarks, Applicants respectfully request that the Examiner reconsider the outstanding objections and rejections and they be withdrawn.

Rejections Under 35 U.S.C. §102

In the Office Action, claims 1-5 and 24-26 have been rejected under 35 U.S.C. §102(b) for being anticipated by U. S. Patent No. 5,790,219 issued to Yamagishi, *et al.* ("Yamagishi"). This rejection is respectfully traversed.

In response to Applicants' previous amendment and arguments, the Examiner asserted "Those portions of Yamagishi et al. cited by the Examiner can be reasonably interpreted as being grooves as claimed by applicant based on claim 4 and figure 8 of the applicant's disclosure. Claim 4 recites the feature of grooves in the color filter based on the black matrix. These grooves would have to be formed at the boundary regions of the pixel area since the black matrix is also

formed there. Furthermore, figure 8 is further evidence that the disclosure of Yamagishi et al. anticipates the grooves claimed by the applicant ..." (Office Action, pages 5-6).

In this response, independent claim 1 has been amended to clarify the difference between the claimed invention and Yamagishi. Amended claim 1 further recites "each groove formed within a corresponding one of the plurality of pixel regions and *dividing the corresponding pixel region into a plurality of domains*". This claimed feature is shown in Figs. 3 and 8, in which the pixel region is divided into a plurality of domains by the groove (e.g., long central aperture 150) regardless of whether there is formed a black matrix portion 14 between the groove 150 and the substrate, as shown in Fig. 8.

In this regard, Fig. 4 of Yamagishi neither teaches nor suggests a multi-domain pixel region. Specifically, as previously argued, the grooves formed in the color filters 8 are in fact the boundaries of the color filters, and these grooves do not divide the pixel regions therebetween into a plurality of domains, as claimed, regardless of whether there is formed a black matrix between the boundaries and the substrate 10. Thus, it is respectfully submitted that Yamagishi fails to teach or suggest "each groove formed within a corresponding one of the plurality of pixel regions and *dividing the corresponding pixel region into a plurality of domains*" as recited in claim 1.

In this response, claims 4 has been amended for clarification. Amended claim 4 recite "The panel for a liquid crystal display as recited in claim 3, wherein the black matrix defines the pixel area". Claim 3 recites "The panel for a liquid crystal display as recited in claim 1, further comprising a black matrix formed on the substrate". The features of claims 3 and 4 are described in Fig. 2, in which "a black matrix 14 ... is formed on a transparent insulating substrate 10 to define pixel areas" (Specification, page 7, lines 7-9).

Regarding the embodiment shown in Fig. 8 of the present application, claim 5 has been amended to recite "The panel for a liquid crystal display as recited in claim 1, further comprising *a black matrix portion* formed between the groove and the substrate". It should be noted that claim 5 recites "a black matrix portion" to particularly claim the particular portion of the black matrix 14 that is formed between the groove 150 and the substrate 10 in Fig. 8 and to be distinguishable from "the black matrix" recited in claims 3 and 4 that defines the pixel regions as shown in Fig. 2 and 3 of the present application.

It is believed that, upon the amendments made in claim 1, 4 and 5, it would be clear that the groove recited in claim 1 is formed within the corresponding pixel region to divide the corresponding pixel region into a plurality of domains regardless there is formed a black matrix portion between the groove and the substrate. The particular embodiment shown in Fig. 8, in which an additional black matrix portion is formed between the groove and the substrate is recited in dependent claim 5. The feature of the black matrix shown in Figs. 2 and 3 are recites in claims 3 and 4.

Thus, the boundary of the color filters 8 shown in Fig. 4 of Yamagishi would not be interpreted as the same grooves recited in claims 1 and 5 since (a) the boundaries of the color filters *do not divide* its corresponding pixel region into a plurality of domains, as recited in claim 1, and (b) the black matrix 7 in Fig. 4 is formed between the boundaries of the color filters 8 and the substrate 10, *not between a substrate and a groove* that divides its corresponding pixel region into a plurality of domains. Accordingly, Applicants respectfully submit that claim 1 is patentable over Yamagishi. Claims 2-5 that are dependent from claim 1 would be also patentable at least for the same reason.

Independent claim 24 recites "wherein the common electrode has a plurality of grooved portions, each grooved portion is formed within a corresponding one of the plurality of pixel regions and *dividing the corresponding pixel region into a plurality of domains*". As previously mentioned, Yamagishi fails to teach or suggest the claimed feature of each groove "formed within a corresponding one of the plurality of pixel regions and *dividing the corresponding pixel region into a plurality of domains*". Accordingly, claim 24 and its dependent claims 25 and 26 would be also patentable over Yamagishi at least for the same reason.

Accordingly, Applicants respectfully request that the rejection over claims 1-5 and 24-26 be withdrawn.

Rejections Under 35 U.S.C. §103

In the Office Action, claims 27-30 have been rejected under 35 U.S.C. §103(a) for being unpatentable over Yamagishi. This rejection is respectfully traversed.

In the Office Action, the Examiner asserted that "This method claim does not disclose anything that is patentably distinguishable from the device of claims 1-5 as the method steps are merely a recitation of structural elements. Therefore, this method would have been obvious to one of ordinary skilled in the art at the time of the invention" (Office Action, page 5). This assertion is respectfully disagreed with.

In this response, independent claim 27 has been amended to recite "A method of manufacturing a panel for a liquid crystal display, comprising the steps of: forming a black matrix on a substrate; forming color filters having grooves on the substrate, *each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains*; and forming a common electrode on the color filters".

As previously mentioned, Yamagishi fails to show the claimed feature "*each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains*". Thus, it would not have been obvious to modify the teachings of Yamagishi to arrive at the claimed process step of "forming color filters having grooves on the substrate, *each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains*" as recited in claim 27.

It is submitted that claims 27 is patentable over Yamagishi. Claims 28-30 that are dependent from claim 27 would be also patentable over Yamagishi at least for the same reason. Accordingly, Applicants respectfully request that the rejection over claims 27-30 be withdrawn.

In the Office Action, claims 6-23 have been rejected under 35 U.S.C. §103(a) for being unpatentable over Yamagishi in view of U. S. Patent No. 5,309,264 issued to Lien, *et al.* ("Lien"), and further in view of U. S. Patent No. 5,608,556 issued to Koma ("Koma"). This rejection is respectfully traversed.

Independent claim 6 recites "A liquid crystal display, comprising: a first substrate including pixel electrodes having *apertures*; a second substrate facing said first substrate and including color filters having *grooves* and a common electrode formed on the color filters; and a plurality of pixel regions formed in said first substrate, wherein *each groove is formed within a corresponding one of the plurality of pixel regions and divides the corresponding pixel region into a plurality of domains*".

As previously mentioned, Yamagishi fails to teach or suggest the claimed feature of "*each groove is formed within a corresponding one of the plurality of pixel regions and divides*

the corresponding pixel region into a plurality of domains". Also, as the Examiner admits, "Yamagishi does not disclose pixel electrodes with apertures" (Office Action, page 3).

Thus, claim 6 is distinguishable from the primary reference to Yamagishi since Yamagishi fails to teach or suggest not only "a first substrate including pixel electrodes having *apertures*" but also "a second substrate facing said first substrate and including color filters having *grooves* and a common electrode formed on the color filters".

The Examiner asserted "Lien et al. discloses a liquid crystal display having a multi-domain cell with apertures in the common electrode, it was well known and obvious to those ordinary skilled in the art that apertures in the pixel electrode could also be used to create multi-domain displays as evidenced by the disclosure of Koma. … Therefore it would have been obvious to those of ordinary skilled in the art at the time of the invention to add aperture to the pixel electrodes in the display of Yamagishi" (Office Action, page 3). This assertion is respectfully disagreed with.

Neither Lien nor Koma teaches or suggests a liquid crystal display having both "a first substrate including pixel electrodes having *apertures*" and "a second substrate facing said first substrate and including color filters having *grooves*", as recited in claim 6. Particularly, Lien teaches "a *common electrode* has a pattern of openings therein" (abstract), but fails to teach or suggest "*color filters having grooves*" and "*pixel electrodes* having *apertures*", as recited in claim 6. Koma teaches a common electrode 32 having an orientation control window 33a in Fig. 5, but fails to teach "*color filters having grooves*". as recited in claim 6.

Thus, none of the applied references teaches or suggest the claimed feature of "a second substrate facing said first substrate and including color filters having *grooves*". Thus, even if the liquid crystal display shown in Fig. 4 of Yamagishi is modified to have the pattern of openings or

the orientation control window in the common electrode, as described in Lien and Koma, respectively, the resulting structure would not result in the claimed " liquid crystal display, comprising: ... a second substrate ... including color filters having *grooves* and a common electrode formed on the color filters; ...wherein *each groove is formed within a corresponding one of the plurality of pixel regions and divides the corresponding pixel region into a plurality of domains*".

Therefore, it is submitted that claim 6 is patentable over Yamagishi, Lien and Koma. Claims 7-23 that are dependent from claim 6 would be also patentable at least for the same reason. Accordingly, Applicants respectfully request that the rejection over claims 7-23 be withdrawn.

Other Matters

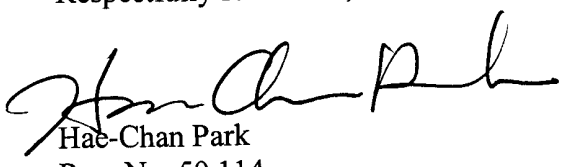
In this response, claims 10 and 26 have been amended in the similar manner with the amendment made in claim 5 to recite the embodiment shown in Fig. 8 of the present application.

CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete response has been made to the outstanding Office Action and, as such, claims 1-30 are in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,



Hae-Chan Park
Reg. No. 50,114

Date: January 7, 2003

McGuire Woods LLP
1750 Tysons Boulevard
Suite 1800
McLean, VA 22102-4215
Tel: 703-712-5000
Fax: 703-712-5050
HCP:WSC/kbs

APPENDIX A

The "marked-up" version of the amended specification is as follows.

1. (Twice Amended) A panel for a liquid crystal display, comprising:

a substrate;

a plurality of pixel regions formed in the panel;

color filters having grooves and formed on the substrate, each groove formed within a corresponding one of the plurality of pixel regions and dividing the corresponding pixel region into a plurality of domains; and

a common electrode formed on the color filters.

4. (Twice Amended) The panel for a liquid crystal display as recited in claim [1] 3, wherein [the grooves based on] the black matrix [define] defines the pixel area.

5. (Twice Amended) The panel for a liquid crystal display as recited in claim 1, [wherein the] further comprising a black matrix portion [has portions overlapping the grooves] formed between the groove and the substrate.

6. (Twice Amended) A liquid crystal display, comprising:

a first substrate including pixel electrodes having apertures;

a second substrate facing said first substrate and including color filters having grooves and a common electrode formed on the color filters; and

a plurality of pixel regions formed in said first substrate,

wherein each groove is formed within a corresponding one of the plurality of pixel regions and divides the corresponding pixel region into a plurality of domains.

10. (Twice Amended) The liquid crystal display as recited in claim 6, [wherein] further comprising [the] a black matrix portion formed between the groove and the second substrate [has portions overlapping the grooves].

24. (Twice Amended) A liquid crystal display, comprising:

a first substrate;

a pixel electrode formed on the first substrate;

a plurality of pixel regions, each pixel region being defined as a region overlapping a corresponding one of the plurality of pixel electrodes;

a second substrate facing with the first substrate; and

a common electrode formed on the second substrate,

wherein the common electrode [having] has a plurality of grooved portions, each grooved portion is formed within a corresponding one of the plurality of pixel regions and dividing the corresponding pixel region into a plurality of domains.

26. (Twice Amended) The liquid crystal display recited in claim 24, further comprising a black matrix portion formed between the groove and the second substrate [formed on the second substrate, wherein portions of the black matrix overlap the plurality of grooved portions of the common electrode].

27. (Twice Amended) A method of manufacturing a panel for a liquid crystal display, comprising the steps of:

forming a black matrix on a substrate;

forming color filters having grooves on the substrate, each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains; and

forming a common electrode on the color filters.

APPENDIX B

The "marked-up" version of the amended claims is as follows:

1. (Twice Amended) A panel for a liquid crystal display, comprising:

a substrate;

a plurality of pixel regions formed in the panel;

color filters having grooves and formed on the substrate, each groove formed within a corresponding one of the plurality of pixel regions and dividing the corresponding pixel region into a plurality of domains; and

a common electrode formed on the color filters.

2. The panel for a liquid crystal display as recited in claim 1, wherein the depth of the grooves is smaller than the thickness of the color filters.

3. The panel for a liquid crystal display as recited in claim 1, further comprising a black matrix formed on the substrate.

4. (Twice Amended) The panel for a liquid crystal display as recited in claim 3, wherein the black matrix defines the pixel area.

5. (Twice Amended) The panel for a liquid crystal display as recited in claim 1, further comprising a black matrix portion formed between the groove and the substrate.

6. (Twice Amended) A liquid crystal display, comprising:

a first substrate including pixel electrodes having apertures;

a second substrate facing said first substrate and including color filters having grooves and a common electrode formed on the color filters; and

a plurality of pixel regions formed in said first substrate,

wherein each groove is formed within a corresponding one of the plurality of pixel regions and divides the corresponding pixel region into a plurality of domains.

7. The liquid crystal display as recited in claim 6, wherein the grooves of the color filters overlap the pixel electrodes.

8. The liquid crystal display as recited in claim 6, wherein the depth of the grooves is smaller than the thickness of the color filters.

9. The liquid crystal display as recited in claim 6, further comprising a black matrix formed on the second substrate.

10. (Twice Amended) The liquid crystal display as recited in claim 6, further comprising a black matrix portion formed between the groove and the second substrate.

11. The liquid crystal display as recited in claim 6, wherein the grooves and the apertures form closed domains when they are viewed from above.

12. The liquid crystal display as recited in claim 6, wherein the grooves and the apertures are symmetrically arranged relative to each other.

13. The liquid crystal display as recited in claim 6, wherein the apertures have a first portion extending in a first direction and a second portion extending in a second direction that is different from the first direction.

14. The liquid crystal display as recited in claim 13, wherein the first direction and the second direction are perpendicular to each other.

15. The liquid crystal display as recited in claim 6, further comprising a liquid crystal layer interposed between the first substrate and the second substrate and having liquid crystal molecules of which long axes are vertically aligned relative to the first and the second substrates in the absence of an electric field.

16. The liquid crystal display as recited in claim 15, wherein the liquid crystal molecules have negative dielectric anisotropy.

17. The liquid crystal display as recited in claim 16, wherein the liquid crystal molecules have chirality.

18. The liquid crystal display as recited in claim 15, further comprising a first and a second polarizing films respectively attached on the outer surfaces of the first and the second

substrates, wherein polarizing axes of the first and the second polarizing films are perpendicular to each other.

19. The liquid crystal display as recited in claim 15, wherein a plurality of minute domains are formed in a pixel area by the grooves and the apertures.

20. The liquid crystal display as recited in claim 19, wherein the minute domains' average direction of the long axes of liquid crystal molecules are directed toward two directions.

21. The liquid crystal display as recited in claim 19, wherein the minute domains' average direction of the long axes of liquid crystal molecules are directed toward four directions.

22. The liquid crystal display as recited in claim 20, wherein the average long axes make an angle of 40° to 50° with the polarizing directions of the first and the second polarizing films.

23. The liquid crystal display as recited in claim 21, wherein the average long axes make an angle of 40° to 50° to the polarizing directions of the first and the second polarizing films.

24. (Twice Amended) A liquid crystal display, comprising:

a first substrate;

a pixel electrode formed on the first substrate;

a plurality of pixel regions, each pixel region being defined as a region overlapping a corresponding one of the plurality of pixel electrodes;

a second substrate facing with the first substrate; and

a common electrode formed on the second substrate,

wherein the common electrode has a plurality of grooved portions, each grooved portion is formed within a corresponding one of the plurality of pixel regions and dividing the corresponding pixel region into a plurality of domains.

25. The liquid crystal display recited in claim 24, further comprising color filters having a plurality of grooves and formed on the second substrate, wherein the plurality of grooved portions of the common electrode are formed due to the grooves of the color filters.

26. (Twice Amended) The liquid crystal display recited in claim 24, further comprising a black matrix portion formed between the groove and the second substrate.

27. (Twice Amended) A method of manufacturing a panel for a liquid crystal display, comprising the steps of:

forming a black matrix on a substrate;

forming color filters having grooves on the substrate, each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains; and

forming a common electrode on the color filters.

28. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the common electrode is form by two depositions of ITO (indium thin oxide).

29. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the step of forming color filters having grooves comprises the substeps of:

coating and patterning a red colored photoresist to form red color filters having grooves located in a pixel area defined by the black matrix;

coating and patterning a green colored photoresist to form green color filters having grooves located in a pixel area; and

coating and patterning a blue colored photoresist to form blue color filters having grooves located in a pixel area.

30. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the step of forming the color filters comprises the substeps of:

sequentially forming red, green, and blue color filters by coating and patterning a red colored photoresist, a green colored photoresist, and a blue colored photoresist; and

patterning the red, green and blue color filters to form the grooves.